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SPECIFICATION FOR AIR CARGO BASE SANDWICH PANEL

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SPECIFICATION FOR AIR CARGO BASE SANDWICH PANEL

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Indian Standard

SPECIFICATION FOR AIR CARGO BASE SANDWICH PANEL

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 January 1977, after the draft finalized by the Containers and Pallets for Air Transport Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 Sandwich panels are used in construction of base for air cargo pallets and containers. The core is generally made of belco balsa wood which is a scarce material in our country.

0.3 In order to have an indigenous substitute for belco balsa wood, tests were carried out by Forest Research Institute, Dehra Dun on different species of wood available in the country. On the basis of their test results, Indian timber species as substitutes for the belco balsa wood have been recommended in this standard.

0.4 Assistance has been derived from the French Specification ALL R 11/ALR 8 'Belco balsa wood used as core material' and ASTM Designation D 903-49 (Reapproved 1972) 'Standard method of test for peel or stripping of adhesive bonds', issued by the American Society for Testing and Materials.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.6 In view of the statutory changeover, the values given in the standard are in SI units only.

1. SCOPE

1.1 This standard deals with the selection of material, construction and test requirements for sandwich panel for air cargo pallets and containers.

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*Rules for rounding off numerical values (*revised*).

2. MATERIAL

2.1 Core Material — The wood used for the purpose shall be belco balsa, kiln-dried at the source, or one of timber species given in Appendix A.

2.1.1 The wood for core shall be delivered in either of the following forms:

a) Planks:

1) Thickness	30 mm, 45 mm, 55 mm, 70 mm and 80 mm
2) Width (*Min*)	50 mm
3) Length (*Min*)	600 mm

b) Blocks:

1) Thickness (*Max*)	400 mm
2) Width (*Max*)	1 500 mm
3) Length (*Min*)	300 mm. No butt joints shall be allowed

c) Cores:

1) Thickness	As per to purchaser's specification
2) Width (*Max*)	400 mm
3) Length (*Max*)	1 500 mm

2.1.2 *Moisture Content* — The basic wood for core shall be kiln-dried to have mositure content in the range of 5 to 15 percent, based on oven-dry mass in any one piece.

2.1.3 *Density* — The density of each wooden plank shall not be less than 96 kg/m^3, nor more than 256 kg/m^3; when supplied in the form of resin bonded blocks or cores. The average density of the individual blocks or cores shall not be more than the maximum density specified by the purchaser.

2.1.4 The wood selected for the core shall be permitted to have the usual timber defects as under:

a) Pitch	Enclosed and/or surface — not acceptable
b) Knots	Sound, tight knots or holes may be permitted provided the average diameter of individual knots or holes does not exceed 65 mm and adjacent knots or holes are not closer than 38 mm
c) Water heart	Not acceptable
d) Burls, twig specks, birds eyes, pin, cluster	Occassional area acceptable

e) Blue stain	Permitted provided it is not associated with decay
f) Mineral stain	Permitted provided it is not associated with decay
g) Worm holes	Pin worm holes provided the maximum concentration is 400 per square metre and occasional grub holes up to 5 mm are acceptable

h) Checks, splits on each lateral surface or face extended no deeper than 25 mm with a width of not more than 3 mm shall be permitted. Internal and end checks are acceptable.

2.2 Skin Material — Aluminium alloy sheet of Types I and II conforming to IS : 3436-1966*, of thickness 0·9 to 1·5 mm, shall be used for the top and bottom skin material. Any other aluminium sheet of equivalent strength and elongation may also be used for the purpose if agreed between the purchaser and the supplier.

2.3 Adhesive

2.3.1 The adhesive used in the fabrication of wooden blocks shall be BWR or WWR (unextended) type conforming to IS : 848-1963†.

2.3.2 In joining the skin material with the core, an adhesive suitable for bonding metal to wood and which can withstand the peel strength test as specified in **4.2** shall be used.

3. CONSTRUCTION

3.1 The wooden planks shall be planed so as to provide smooth, clean and well-fitting surfaces and shall be fabricated into primary panels and then into blocks as soon as practicable after planing.

3.2 After final planing, the core shall be pre-assembled, without adhesive, for dimensional inspection and for fit of the individual wooden panels.

3.3 The wood for core shall be conditioned if required in accordance with the recommendations of the adhesives manufacturer.

3.4 Adhesive Application

3.4.1 Adhesive may be applied to the facing surfaces with a rubber roll adhesive spreader, spray gun or hand spread with a stiff bristled brush.

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*Specification for aluminium-clad aluminium alloy sheet, strip and coil for aircraft purposes.

†Specification for synthetic resin adhesive for plywood (phenolic and aminoplastic).

3.4.2 The adhesive shall be applied to a single surface or to both the surfaces of a joint, so as to result in an adhesive mass of 300 g to 400 g per square metre of glueline.

3.4.3 The adhesive shall be so applied to the bonding surfaces that after curing there shall be no unbonded surfaces.

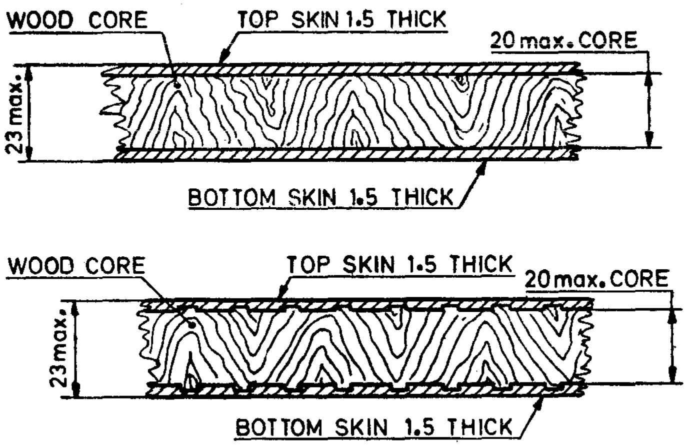
3.4.4 *Application of Pressure* — While converting planks to primary panels and panels to blocks, a minimum pressure of 196·0 kN/m^2 shall be applied to all mating surfaces of the assembly in the press or clamping fixture.

3.4.5 After bonding, the blocks shall not be subjected to further processing till maturation period of 2 days at room temperature has elapsed.

3.5 Dimensions of Sandwich Core — The wooden core for the sandwich panel shall be of the following dimensions:

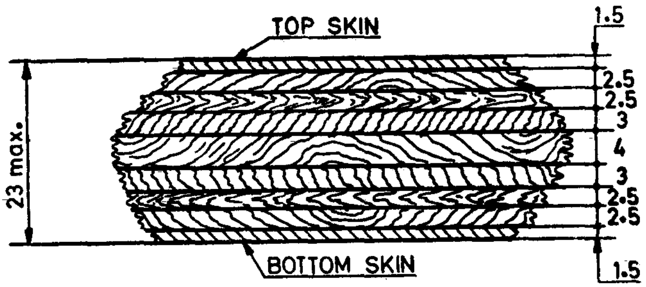
Width	50 mm *Min*
Length	610 mm *Min*
Thickness	20 mm *Max*

NOTE — Typical cross sections of the sandwich panels are shown in Fig. 1 and 2.



All dimensions in millimetres.

FIG. 1 TYPICAL WOOD SANDWICHED PANEL FOR CONTAINERS AND TYPE A AND B AIR CARGO PALLETS RATED TO 1·5 G OR 3 G OR 9 G



All dimensions in millimetres.

FIG 2 TYPICAL WOOD LAMINATED CONSTRUCTION TYPE SANDWICHED PANEL

4. TESTS

4.1 Strength Test — The complete sandwich panel assembly fabricated for use in the manufacturing of the pallet shall be tested in accordance with 'Indian Standard test code for air cargo pallets' (*under preparation*) and Indian Standard specification for certified lower deck containers for high capacity aircraft: Part II Testing' (*under preparation*).

4.2 Peel Strength Test

4.2.1 *Procedure* — The fabricated sandwich panel specimen of 75 mm width shall be tested by the method given in Appendix B.

4.2.2 *Requirements*

4.2.2.1 The average peel strength value shall be 202 N. No individual test shall have peel strength less than 158 N.

4.2.2.2 The peel test specimen of sandwich core panel, which fails the wooden core in tension in 40 to 60 percent, 60 to 80 percent, 80 to 95 percent, or 95 to 100 percent of the peel test area, shall have an average peel strength, not less than 178 N, 158 N, 138 N and 113 N, with each specimen value not less than 158 N, 138 N, 113 N and 89 N, respectively.

4.3 Flame Resistance Test — The complete assembly of the sandwich panel shall be self-extinguishing, or may not havean average burn rate greater than 65 mm/min when tested horizontally as specified in Appendix C.

5. ACCEPTANCE

5.1 All items of the sandwich panel shall be inspected to comply with the requirements of this standard before being accepted for fabrication.

5.2 All materials shall meet the requirements specified and all the accepted materials shall be supplied to the fabricator of pallet in standard packages fully protected against weather or humidity effects.

5.3 Each such package shall contain corresponding report and test data showing its compliance to the relevant requirement.

5.4 The fabricated panel assembly shall be certified for the specific use with necessary identification and contain representative test data.

6. MARKING

6.1 Each sandwich panel shall be marked with the following information:

a) Name of the manufacturer;

b) Batch number and year of manufacture; and

c) Size and rating as prescribed in IS : 7074-1973*.

6.1.1 The sandwich panel complying with the requirements of this specification may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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*General requirements for air cargo pallets.

APPENDIX A

(*Clause* 2.1)

RECOMMENDED SPECIES OF TIMBER FOR SANDWICH CORE PHYSICAL AND MECHANICAL PROPERTIES

(For information only)

SL No.	SPECIES AND TRADE NAME	SEASONING CONDITION	PERCENTAGE MOISTURE CONTENT	SPECIFIC GRAVITY	MODULUS OF RUPTURE	MODULUS OF ELASTICITY	MAXIMUM CRUSHING STRESS	MAXIMUM STRESS RADIAL	SHEAR TANGENTIAL
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					kN/m²	kN/m²	kN/m²	kN/m²	kN/m²
1.	*Crytomeria japonica*	Green	141·7	0·229	19610	24 × 10^5	981	3685	4365
		Air dry	12·0	0·236	25230	27 × 10^5	1432	4010	4350
2.	*Bombay species	Green	121·5	0·329	37470	50 × 10^5	1775	3862	4770
		Air dry	12·0	0·333	49980	58 × 10^5	2374	3910	5355

*While using Bombay species the weight of the sandwich panel be controlled by reducing core thickness.

APPENDIX B

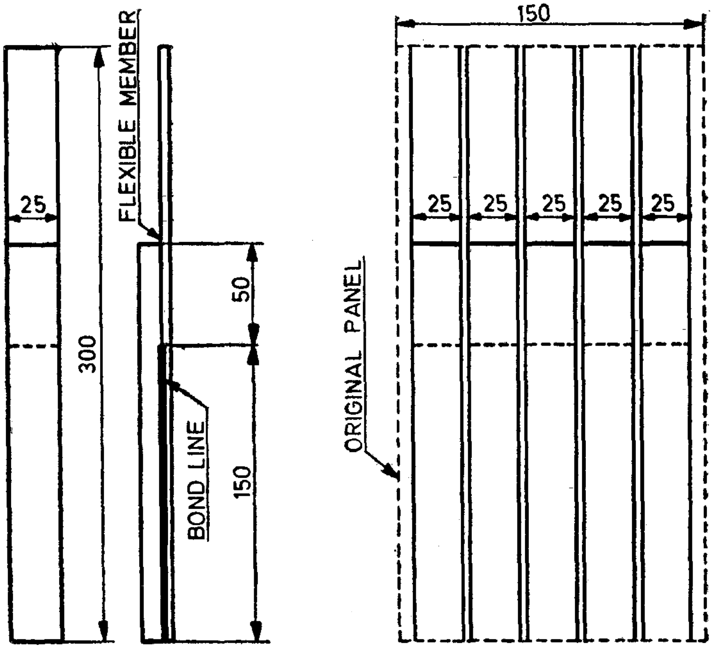
(*Clause* 4.2.1)

PEEL STRENGTH TEST

B-1. TEST SPECIMEN

B-1.1 The test specimen shown in Fig. 3 and 4 shall consist of one piece of flexible member 25 × 300 mm bonded for 150 mm at one end to one piece of flexible or rigid material, 25 × 200 mm, with the unbonded portion of each member, being face to face.

B-1.2 In order to maintain a separation rate of 150 mm/min the specimen shall be relatively non-extensible in the expected loaded range. Where the material is sufficiently extensible to lessen radically the separation rate, it shall be backed up with a suitable non-extensible material. The backing material and method shall be completely identified.



3A Test Specimen

3B Specimens from Bonded Panel

All dimensions in millimetres.

FIG. 3 TEST SPECIMEN

B-1.3 The test materials shall be thick enough to withstand the expected tensile pull but not over 3 mm in thickness. The standard thickness of specimen shall be, metals 1·5 mm, wood 3 mm, and plastics 1·5 mm. Other special materials as well as the standard materials, shall be completely identified separately.

B-1.4 At least 10 test specimens shall be tested for each adhesive.

B-1.5 Any test specimen whose test result is out of line due to some flaws, shall be discarded and retest made.

B-2. CONDITIONING

B-2.1 Condition all specimen for 7 days by exposure to relative humidity of 50 ± 2 percent at 20 ± 3°C or until equilibrium is reached, except where the adhesive manufacturer has specified any ageing period.

B-2.2 Special conditioning procedures may be used by agreement between the purchaser and the manufacturer.

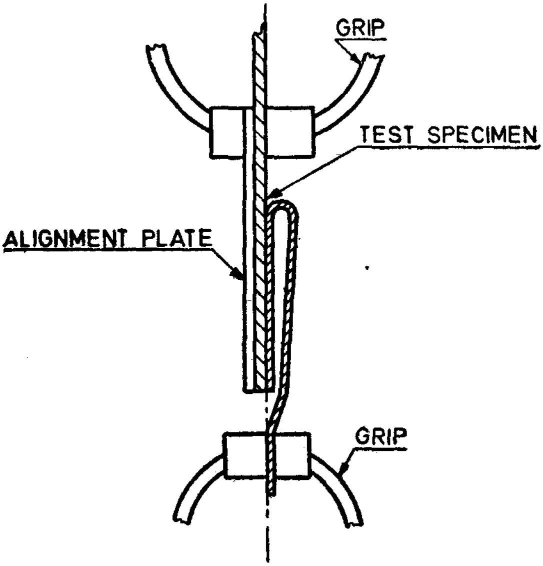


Fig. 4 Specimen Under Test

B-3. PROCEDURE

B-3.1 The test shall be conducted as soon as possible after removing the test specimen from the conditioning atmosphere, preferably under the same condition.

B-3.2 Separate the free end of the 25 mm wide flexible member by hand from the other member for a distance of about 25 mm. The test specimen be placed in testing machine by clamping free end of the 200 mm long member in one grip, turning back the free end of the flexible member and clamping it in the other grip (*see* Fig. 4). Attach the separated end of the specimen with all separate parts, except the one under test, securely gripped to the recording head by means of clamp. Care should be taken to adjust the test specimen symmetrically so that tension is uniformly distributed. The test specimen shall be maintained in the plane of the clamps during test. This may be done either by attaching the minimum weight required to the free end of the specimen or by holding the specimen against and alignment plate attached to the stationary clamp (*see* Fig. 4). Take into account the added weight in determining the load causing the separation in all cases. Grip the 25 mm wide flexible member symmetrically and firmly without twisting.

Adjust the autographic mechanism and chart to zero and start the machine. Strip the separating member from the specimen approximately at an angle of 180° and continue the separation for a sufficient distance to indicate the peeling value. Peel at least one half of the bonded area, even though a peel or stripping value may be indicated before this point.

APPENDIX C

(*Clause* 4.3)

FLAME RESISTANCE TEST

C-1. TEST SPECIMEN

C-1.1 The specimen thickness shall be not thicker than the minimum thickness to be qualified for use in the aeroplane.

C-1.2 The test shall be carried out with the test specimen held horizontal above the flame, the two long edges and the edge away from the flame are held securely.

C-1.3 The exposed area of the specimen shall at least 52 mm wide and 305 mm long, unless the actual size used in the aeroplane is smaller.

C-1.4 The edge to which the burner flame is applied shall not consist of the finished or protected edge of the specimen but shall be representative of the actual cross section of the material or part installed in the aeroplane.

C-2. CONDITIONING

C-2.1 The specimen shall be conditioned to 20 ± 3°C and 50 ± 2 percent relative humidity till moisture equilibrium is reached for 24 hours. Only one specimen at a time may be removed from the conditioning environment immediately before subjecting it to the flame.

C-3. PROCEDURE

C-3.1 Horizontal Test — A minimum of three specimen shall be tested and the results averaged. Each specimen shall be supported horizontally. The surface which will remain exposed when installed in the aircraft, must be face-down for the test. The specimen shall be exposed to a Bunsen burner or Tirril burner with a tube of inner diameter 10 mm adjusted to give a flame of 38 mm height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the centre of the flame shall be 842°C. Specimen shall be positioned so that the edge being tested is 20 mm above the top of, and on the centre line of the burner. The flame shall be applied for 15 seconds and then removed. A minimum of 255 mm of the specimen shall be used for timing purposes, approximately 38 mm shall burn before the burning front reaches the timing zone, and the average burn rate shall be recorded.

C-3.2 Burn Length — Burn length is the distance from the original edge to the farthest evidence of damage to the test specimen due to the flame impingment including area of partial or complete consumption, charring or embrittlement, but not including areas sooted, stained, warped or disclosed, nor where material has shrunk or melted away from the heat source.

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7073 (Part I)-1973 Glossary of terms relating to air cargo pallets and containers: Part I Air cargo pallets

7074-1973 General requirements for air cargo pallets

7917 (Part I)-1975 Air cargo freight containers: Part I General requirements

7917 (Part II)-1975 Air cargo freight containers: Part II Testing

8169 (Part I)-1976 Air cargo containers — main deck container (2 438 × 2 438 mm) for high capacity aircraft: Part I General requirements

8169 (Part II)-1976 Air cargo containers — main deck container (2 438 × 2 438 mm) for high capacity aircraft: Part II Testing

8396-1977 Air cargo base sandwich panel